Spacelab
Data Processing
Facility

NASA

Thundering roars from a spacecraft being propelled from its launch pad . . . cheering onlookers nudging into the scene of yet another bit of history . . . dramatic voice transmissions between earth and "beyond the horizon."

Foreword

All of these events still occur, but the emphasis at NASA today is more and more toward the efficient and "reusable" application of limited experimentation time in space after the delivery system has done its job.

One exciting project is Spacelab, a series of exacting missions designed to provide extensive knowledge of near and deep space.

Housed onboard the Space Shuttle Orbiter, a single Spacelab mission may feature many varied scientific experiments. Voluminous data streams result, requiring an adaptable, reliable facility to accept and process them. The Spacelab Data Processing Facility (SLDPF), at the Goddard Space Flight Center (GSFC), has been developed to handle the payload data from Spacelab missions. Furthermore, the SLDPF capabilities are not limited to Spacelab; the SLDPF can also support attached Shuttle payloads utilizing the Spacelab onboard data system.

NASA prepared this publication to highlight the capabilities of the SLDPF — the capturing, quality monitoring, processing, accounting, and forwarding of vital Spacelab data to various user facilities around the world.

Concept

Flexibility, reliability, reusability . . . these are the advantages the Spacelab Data Processing Facility (SLDPF) offers to a user seeking to process space data.

Whether an onboard Spacelab experiment belongs to a space particles investigator in Japan or to a microwave remote-sensing experimenter in Germany, the SLDPF flexibility is shown by its ability to capture and record a wide variety of data types (digital, audio, and analog) as required to support an experiment.

The flexibility of the SLDPF is further demonstrated by the wide range of data rates that can be handled. K-band channels 2 and 3 digital data are captured by the SLDPF at a rate of up to 2 megabits per second (Mbps) for channel 2 and at a rate of 2 to 50 Mbps for channel 3. Analog data are also captured by the SLDPF, at a rate of 4.2 Megahertz (MHz), for an early Spacelab mission.

To implement this flexibility, the SLDPF is divided into two major functional elements — the Spacelab Input Processing System (SIPS) and the Spacelab Output Processing System (SOPS). After capturing the digital telemetry data stream, the SIPS demultiplexes, synchronizes, time tags, quality checks, accounts for the data, and formats the data onto computer-compatible tapes (CCTs). For further processing, the digital data are then transferred to the SOPS where they are edited, time ordered, quality checked, blocked, formatted for distribution, and recorded onto tapes for shipment to the user. Throughout this processing, data accountability is maintained by the SOPS. Audio and analog data products, which are generated in the SIPS, are output directly to the users. When specifically requested by the user, selected digital tape products may also be obtained from the SIPS.

Reliability has been incorporated into the SLDPF design. If any part of the SIPS online components becomes inoperable, a second system provides redundancy.

The Shuttle reusable concept is also reflected in the SLDPF. To ensure reusability of the SLDPF, input data stream characteristics and output data format requirements are not "hard coded" within the system. For example, the SIPS hardware is programmable during the mission for varying predefined input data stream characteristics. The SLDPF configuration utilizes parameter files that adapt the SIPS and SOPS software and hardware to the specific data processing requirements of each mission. Thus, the SLDPF is reusable from Spacelab mission to mission, as well as for other projects in the space program utilizing the Spacelab onboard data system.
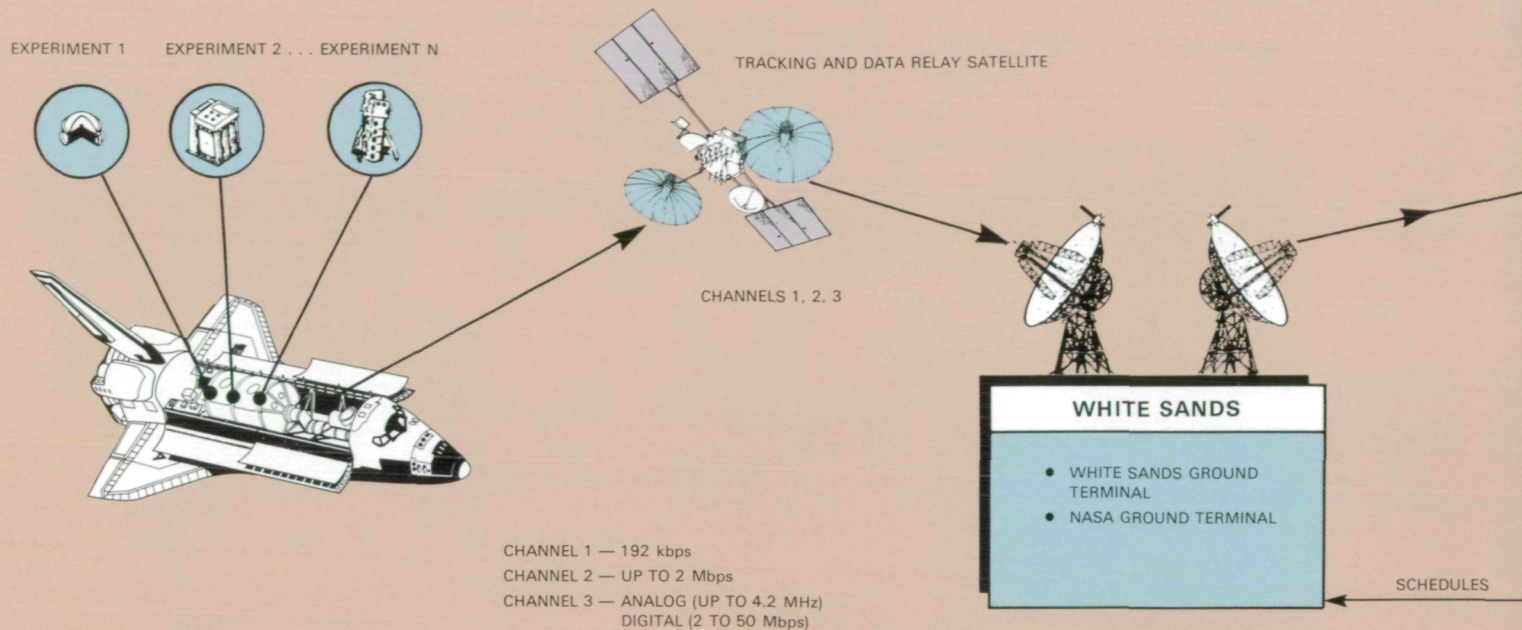
The Spacelab Data Network

The Spacelab data network begins with the onboard Spacelab High-Rate Multiplexer (HRM), which gathers data for transmission to the Tracking and Data Relay Satellite System (TDRSS) through the Shuttle Orbiter K-band signal processor. The TDRSS/Domsat link then relays the data to GSFC. Here the data are captured and processed within the SLDPF before distribution to the users.
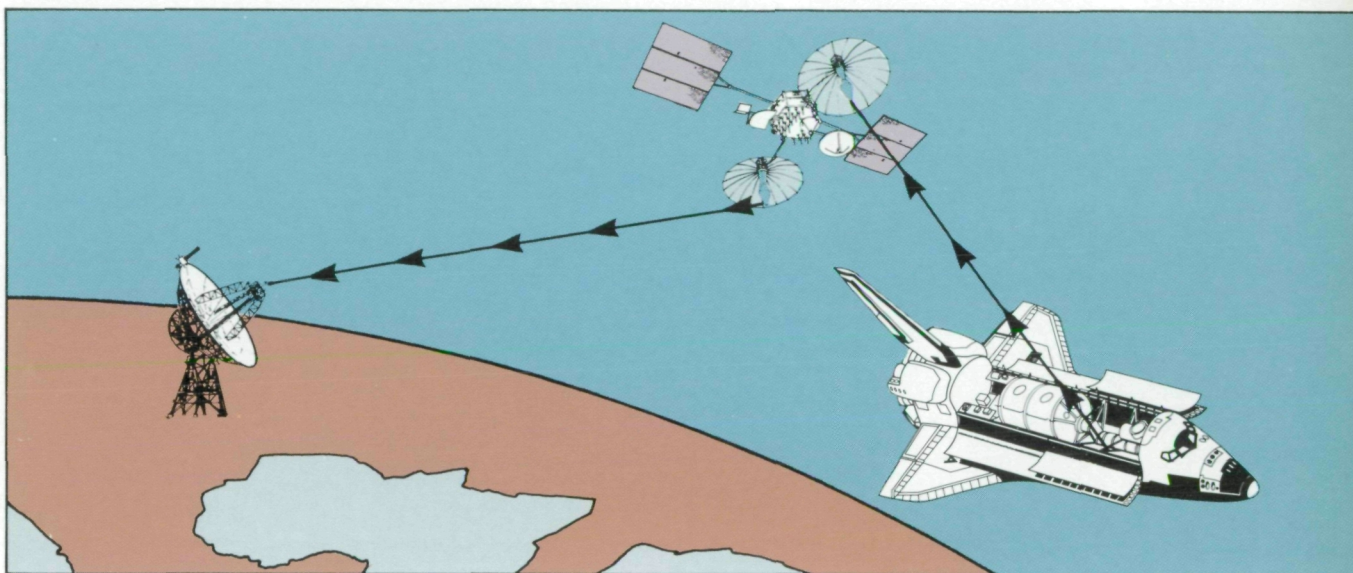
The SLDPF Interfaces

In fulfilling overall system requirements, the SLDPF interfaces with other NASA centers — the Marshall Space Flight Center (MSFC), the Johnson Space Center (JSC), and the Kennedy Space Center (KSC). For prelaunch verification, the KSC provides test data for SLDPF premission processing and shipment to the users. The MSFC, which has mission management responsibilities for the early Spacelab missions, levies project requirements upon the SLDPF and supplies premission products essential to mission specific support. The JSC and the MSFC coordinate real time mission support that includes data quality monitoring and updating of the nominal timeline. After the mission is completed, the JSC also supplies Spacelab and Orbiter ancillary data to the SLDPF.

The Spacelab Data Network

EXPERIMENT 1   EXPERIMENT 2 . . . EXPERIMENT N

TRACKING AND DATA RELAY SATELLITE

CHANNELS 1, 2, 3

WHITE SANDS

- WHITE SANDS GROUND TERMINAL
- NASA GROUND TERMINAL

CHANNEL 1 — 192 kbps
CHANNEL 2 — UP TO 2 Mbps
CHANNEL 3 — ANALOG (UP TO 4.2 MHz)
            DIGITAL (2 TO 50 Mbps)

SCHEDULES
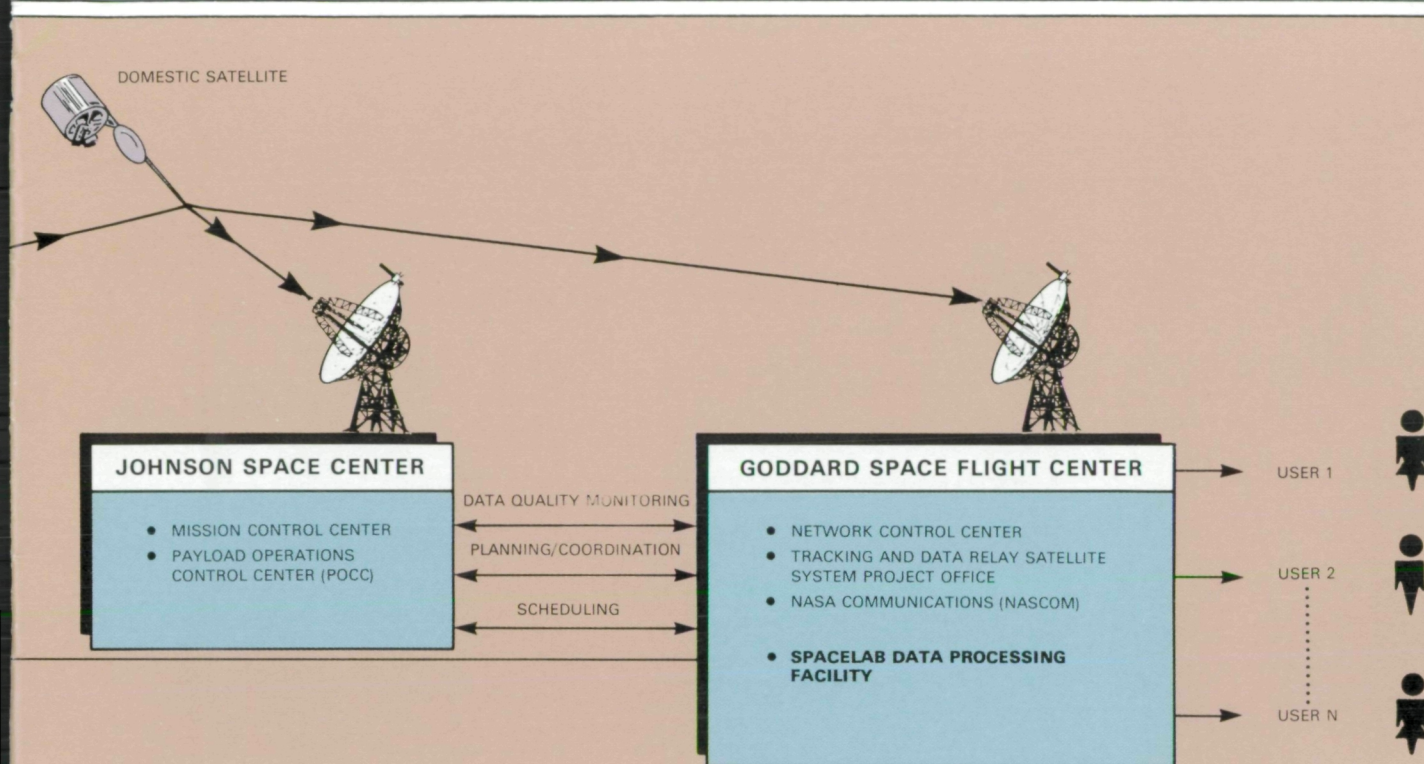
Spacelab High-Rate Multiplexer

- Multiplexes experiment data
- Links with Orbiter K-band signal processor for transmission from Spacelab
- Records on high data rate and analog recorders if link is not available

TDRS

- Receives signals from Shuttle/Spacelab
- Transmits signals to TDRSS receiver at White Sands

White Sands

- Receives signals from TDRSs
- Operates and controls TDRSS
- Provides short-term recording of Spacelab data

4

DOMESTIC SATELLITE

JOHNSON SPACE CENTER
- MISSION CONTROL CENTER
- PAYLOAD OPERATIONS CONTROL CENTER (POCC)

DATA QUALITY MONITORING
PLANNING/COORDINATION
SCHEDULING

GODDARD SPACE FLIGHT CENTER
- NETWORK CONTROL CENTER
- TRACKING AND DATA RELAY SATELLITE SYSTEM PROJECT OFFICE
- NASA COMMUNICATIONS (NASCOM)
- **SPACELAB DATA PROCESSING FACILITY**

USER 1
USER 2
USER N

DOMSAT

- Receives signals from White Sands
- Transmits signals to Goddard Space Flight Center and Johnson Space Center
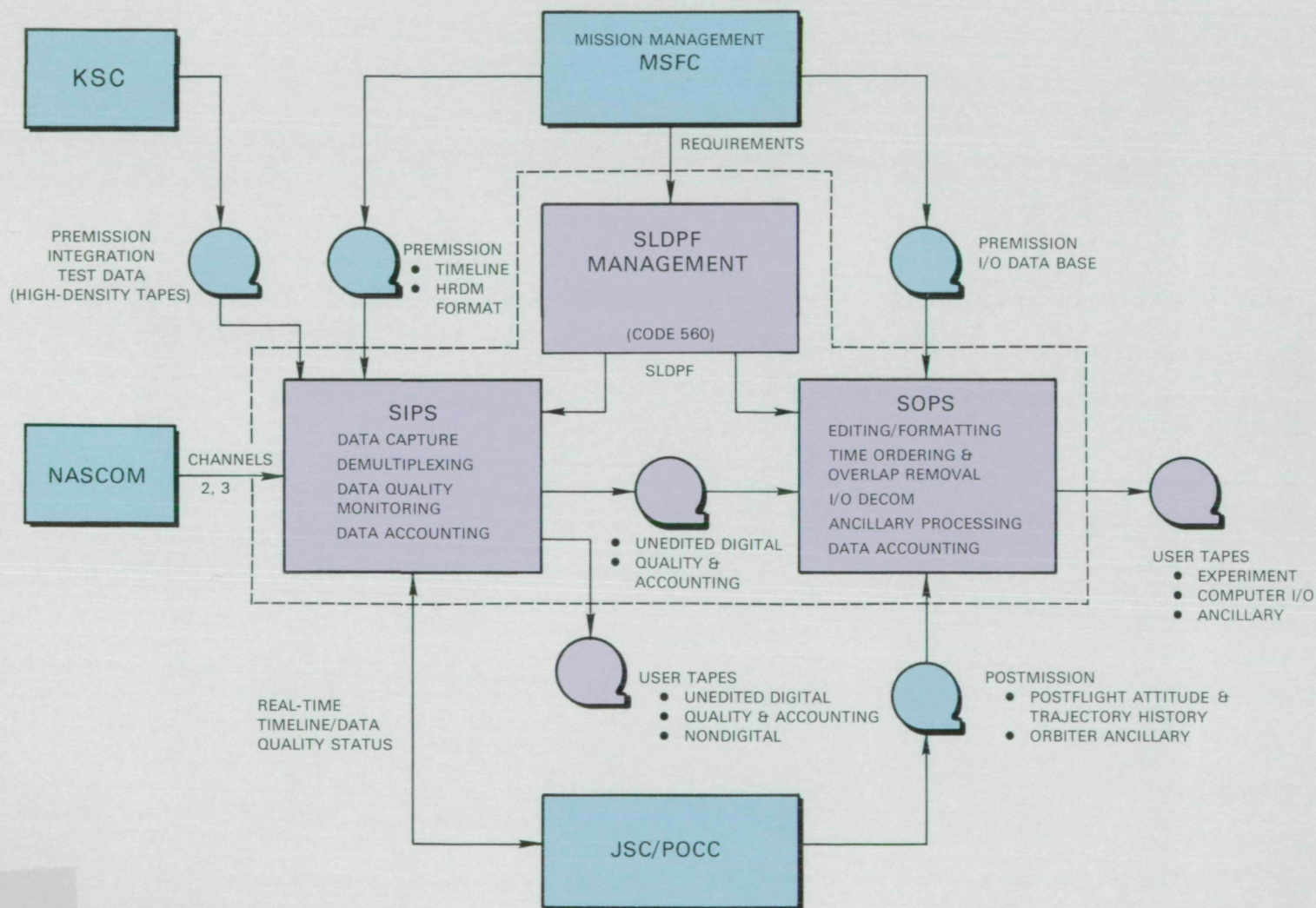
JSC

- Operates and controls the mission
- Schedules data transmissions in conjunction with Network Control Center and TDRSS/ NASCOM management

GSFC

- Receives signals from TDRSS and Domsat through NASCOM
- Coordinates network activities
- Captures, quality monitors, accounts for, and processes data for shipment to users
- Ships data tapes to user community

SLDPF Interfaces

KSC

MISSION MANAGEMENT
MSFC

REQUIREMENTS

PREMISSION
INTEGRATION
TEST DATA
(HIGH-DENSITY TAPES)

PREMISSION
• TIMELINE
• HRDM
FORMAT

SLDPF
MANAGEMENT

(CODE 560)

SLDPF

PREMISSION
I/O DATA BASE

NASCOM

CHANNELS
2, 3

SIPS
DATA CAPTURE
DEMULTIPLEXING
DATA QUALITY
MONITORING
DATA ACCOUNTING

SOPS
EDITING/FORMATTING
TIME ORDERING &
OVERLAP REMOVAL
I/O DECOM
ANCILLARY PROCESSING
DATA ACCOUNTING

• UNEDITED DIGITAL
• QUALITY &
ACCOUNTING

USER TAPES
• EXPERIMENT
• COMPUTER I/O
• ANCILLARY

REAL-TIME
TIMELINE/DATA
QUALITY STATUS

USER TAPES
• UNEDITED DIGITAL
• QUALITY & ACCOUNTING
• NONDIGITAL

POSTMISSION
• POSTFLIGHT ATTITUDE &
TRAJECTORY HISTORY
• ORBITER ANCILLARY

JSC/POCC

6

The SLDPF consists of two primary computing facilities, the SIPS and the SOPS. The SLDPF Management within GSFC (Code 560) coordinates all external interfaces and mission data processing requirements. To perform its functions, the SLDPF has the following interfaces:

Marshall Space Flight Center/Mission Management

— Provides the mission requirements for the SLDPF
— Provides premission timeline and High-Rate Demultiplexer (HRDM) format tapes
— Provides premission I/O data base tape

Johnson Space Center/
Payload Operations Control Center

— Provides timeline updates during the mission
— Coordinates real-time data quality status monitoring with the SIPS
— Provides postmission Spacelab Postflight Attitude and Trajectory History (PATH) and Orbiter Ancillary (OANC) data

Kennedy Space Center

— Provides experiment integration Level IV test data (high-density tapes) for premission testing and user product verification
— Provides integration Level III, II, and I test data for prelaunch verification

Goddard Space Flight Center/
Communications and Control Management

— Provides data link for K-band channels 2 and 3 data through NASA Communications (NASCOM)
— Provides supporting communication links through NASCOM
— Coordinates network activities through the Network Control Center (NCC)

Utilizing the SLDPF

What Are the User Requirements?

For full processing, the experiment data format must be compatible with the High-Rate Multiplexer (HRM). The HRM standards are contained in the Spacelab HRM Format Standards document (see Additional Reading list). If the experiment data format does not completely adhere to the HRM standards, limited processing of the data may still be available within the SLDPF.

Data rates must fall within a threshold acceptable to the HRM; data rates must be within 16 Mbps for dedicated channels and within 50 Mbps for a direct access channel.

What Are the Project Requirements?

The mission manager must provide the following to the SLDPF:
— Mission specific parameters
— HRDM format tape
— Premission timeline tapes
— I/O data base tape
— Premission test tapes
— System mission unique requirements (if any).

What Will the SLDPF Provide?

AUDIO   Audio Tape — Contains selected voice data from the three voice channels for periods requested by the users.

ANALOG   Analog Tape — Contains Verification Flight Instrumentation or filtered analog data for Spacelab-1.

IDT   Instrumentation Data Tape — Contains selected HRDM output channels along with Spacelab Coordinated Universal Time.

HDT   High-Density Tape — Contains the raw-captured K-band channels 2 and/or 3 data.

SEDT   Spacelab Experiment Data Tape — Contains blocked and unedited, demultiplexed channel data from one or more dedicated experiment channels.

SIDT   Spacelab I/O Data Tape — Contains blocked and unedited, demultiplexed Experiment Computer (EC) I/O and Subsystem Computer (SC) I/O channel data.

SQAT   Spacelab Quality Control and Accounting Tape — Contains quality and accounting information for specified SEDT and/or SIDT files.

SECT   Spacelab Experiment Channel Tape — Contains edited and formatted data from one dedicated experiment channel.

SICT   Spacelab I/O Channel Tape — Contains selected decommutated words from the EC I/O and SC I/O channels edited and formatted for individual experimenters.

SANC   Spacelab Ancillary Data Tape — Contains decommutated guidance, navigation, and control (GN&C) words from EC I/O channel with related ancillary parameters. Also contains decommutated and converted housekeeping parameters from the EC I/O and the SC I/O channels.

SPMA   Spacelab Postmission Ancillary Tape — Contains SANC data that have been merged with PATH data received from the JSC.

OANC   Orbiter Ancillary Tape — Contains K-band channel 1 ancillary data from the JSC. OANC tapes are copied and distributed to the users.

Product Summary and Delivery Schedule

	TAPE CHARACTERISTICS		DELIVERY SCHEDULE[1]
	STANDARD	OPTIONS	
SIPS PRODUCTS			
SEDT/SIDT[2]	6250-BPI, 9-TRACK	1600-BPI, 9-TRACK	
SQAT[2]	6250-BPI, 9-TRACK	1600-BPI, 9-TRACK	
IDT[2]	½", 7-TRACK	NONE	SLDPF DATA RECEIPT + 1 MONTH
CAPTURED HDTs[2]	1", 28-TRACK	NONE	
AUDIO	AUDIO CASSETTES	EDITED COPIES OF AUDIO MASTERS	SLDPF DATA RECEIPT + 1 MONTH
ANALOG	½", 7-TRACK	NONE	
SOPS PRODUCTS			
SECT	1600-BPI, 9-TRACK	800-BPI, 6250 BPI, 9-TRACK	
SICT	1600-BPI, 9-TRACK	800-BPI, 6250 BPI, 9-TRACK	SLDPF DATA RECEIPT + 2 MONTHS
SANC	1600-BPI, 9-TRACK	800-BPI, 6250 BPI, 9-TRACK	
SPMA	1600-BPI, 9-TRACK	800-BPI, 6250 BPI, 9-TRACK	PATH RECEIPT + 1 MONTH BUT NO EARLIER THAN 1 MONTH AFTER SANC PROCESSING
OANC COPIES	1600-BPI, 9-TRACK	800-BPI, 6250 BPI, 9-TRACK	RECEIPT OF OANC DATA + 1 MONTH

Notes:

[1] Delivery schedules are based on a 7-day mission average data rate of 1 Mbps for the SIPS and 500 Kbps for the SOPS. Delivery schedules for missions with higher rates must be negotiated.

[2] Tapes generated by the SOPS are the standard SLDPF digital products. Experimenters not conforming to standard HRM data formats or desiring earlier receipt of data may negotiate with the SLDPF for shipment of SEDTs, SIDTs, SQATs, IDTs, and/or captured HDTs.

SLDPF Overall Processing Flow

SIPS Phase 1

During the SIPS Phase 1 processing, K-band channel 2 and/or channel 3 data are captured onto high-density tapes. During the mission, the primary SIPS functions are the real time capture and quality monitoring of the data. The SIPS System Engineering Laboratories (SEL) 32/77 computers may perform digital processing in real time for those HRDM output channels whose aggregate data rate does not exceed the SIPS capability. Analog data from K-band channel 3 are also captured in real-time. After real-time data capture, the HDTs, including playback and direct access channel data, are postprocessed to produce SEDTs and/or SIDTs. During this phase, audio data are captured, and later edited and copied onto audio cassette tapes.
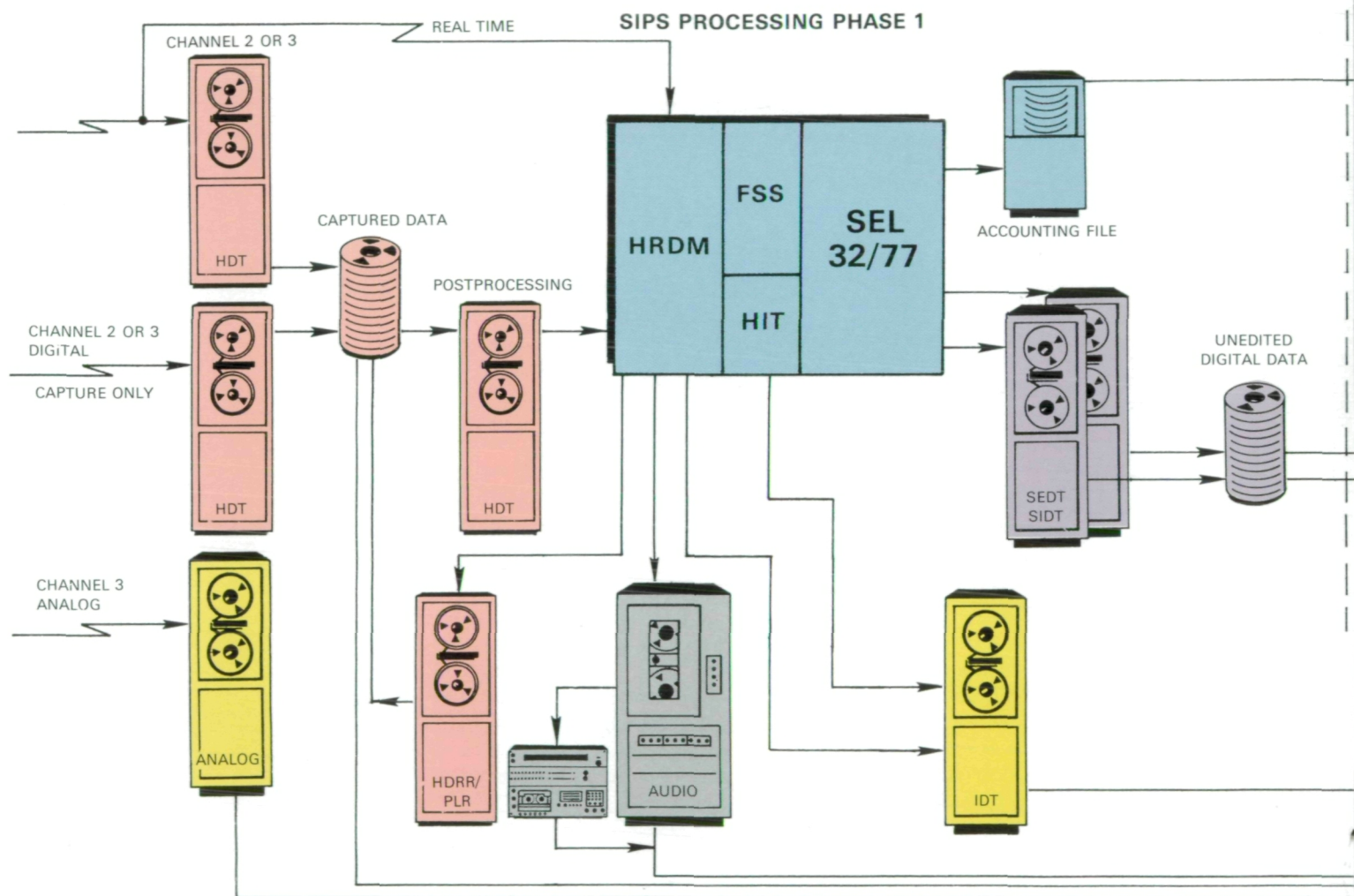
SIPS Phase 2

During the SIPS Phase 2 processing, the completed SEDTs and/or SIDTs are grouped, quality analyzed, and accounted for prior to release to the SOPS. The SQATs are generated at this time containing quality and accounting information corresponding to the SEDT and/or SIDT files to be released.

Copies of the SEDTs, SIDTs, and SQATs for users other than the SOPS are also generated during this phase. In addition, shipping letters for all SIPS products are generated.

SOPS Phase

During the SOPS phase, the digital data contained on the SEDTs and SIDTs are further processed to produce experiment channel tapes, I/O channel tapes, and Spacelab ancillary tapes. The OANC copies are provided for shipment to the users. The major processing functions within the SOPS include time ordering, overlap removal, major frame editing, decommutating from the I/O channels, ancillary processing, and formatting and generating output products. All products distributed by the SOPS are accounted for and are accompanied by shipping information.
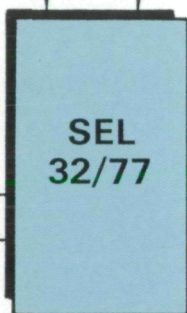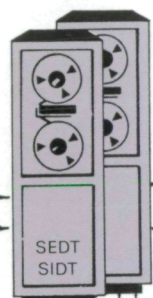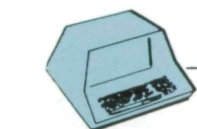
SLDPF Overall Processing Flow

SIPS PROCESSING PHASE 1

REAL TIME

CHANNEL 2 OR 3

HDT

CAPTURED DATA

CHANNEL 2 OR 3
DIGITAL

CAPTURE ONLY

HDT

POSTPROCESSING

HDT

CHANNEL 3
ANALOG

ANALOG

HDRR/
PLR

HRDM

FSS

HIT

SEL
32/77

AUDIO

ACCOUNTING FILE

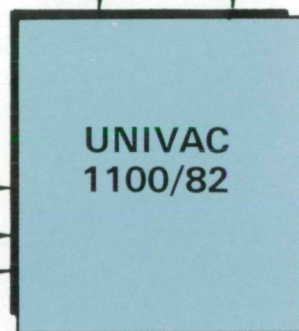SEDT
SIDT

UNEDITED
DIGITAL DATA

IDT
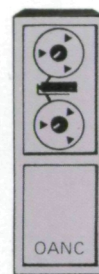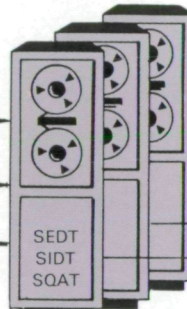
SIPS PROCESSING PHASE 2 (RELEASE)

SOPS PROCESSING PHASE

DIGITAL RELEASE REQUEST

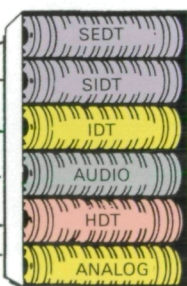SEL 32/77

UNIVAC 1100/82

PATH   OANC

MASTERS

COPIES

SEDT
SIDT

SQAT

SEDT
SIDT
SQAT
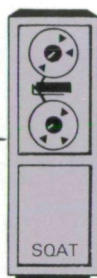
PROCESSED DIGITAL DATA

TAPE STAGING AND STORAGE CENTER

SEDT

SIDT

IDT

AUDIO

HDT

ANALOG

SHIPMENT
TO
USERS

SQAT

SECT

SICT

SANC

SPMA

OANC COPIES

SECT   SICT   SANC   SPMA   OANC
COPIES
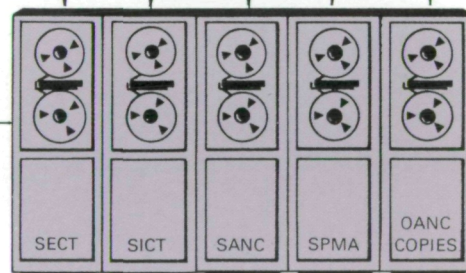
Spacelab/Orbiter Data Flow

SPACELAB

ORBITER

EXP/SUBSYSTEM
COMPUTER DATA

PCM
MASTER
UNIT

NETWORK
SIGNAL
PROCESSOR

96 OR 192 Kbps

S-BAND
PM

RECORDERS

ORBITER UTC

UP TO
16 Mbps
EACH

1 Mbps MAX

ANALOG VOICE
CHANNELS

16 DEDICATED
EXPERIMENT
CHANNELS

HRM

PLR

CHANNEL 1
DIGITAL
96 OR 192 Kbps

EXPERIMENT
COMPUTER

51.2/25.6
Kbps

48 Mbps
HRM
COMPOSITE

LOW RATE
EXPERIMENT DATA

ANCILLARY DATA

SUBSYSTEM
COMPUTER

51.2/25.6
Kbps

COMPOSITE DATA
50 Mbps MAX

K-BAND
SIGNAL
PROCESSOR

CHANNEL 2
DIGITAL
2 Mbps MAX

3 ANALOG VOICE
CHANNELS

CHANNEL 3
DIGITAL
50 Mbps MAX OR
ANALOG/VIDEO
4.2 MHz MAX

DIRECT ACCESS CHANNELS

32
Mbps
MAX

ORBITER CCTV

A/V
RECORDERS

HDRR

SL VIDEO

VIDEO
CONTROL
UNIT

VIDEO

ANALOG/VIDEO

A/V
SWITCH

ANALOG

High-Rate Multiplexer (HRM)

The asynchronous multiplexer collects various input data streams and multiplexes the data into a composite signal of up to 48 Mbps. Data can be formatted into any of 64 predefined formats.

A direct access channel bypasses the HRM functions internally and provides a 50-Mbps downlink capability for a given experiment.

High Data Rate Recorder (HDRR)

Composite data are recorded on the HDRR onboard the Spacelab at rates of up to 32 Mbps during time intervals without TDRSS coverage. The HDRR is played back in reverse and can be multiplexed with real-time data in the composite data stream — this results in a second level of multiplexing.

Payload Recorder (PLR)

The Orbiter PLR serves primarily as a backup to the Spacelab HDRR. Data can be recorded at a rate of up to 1 Mbps.
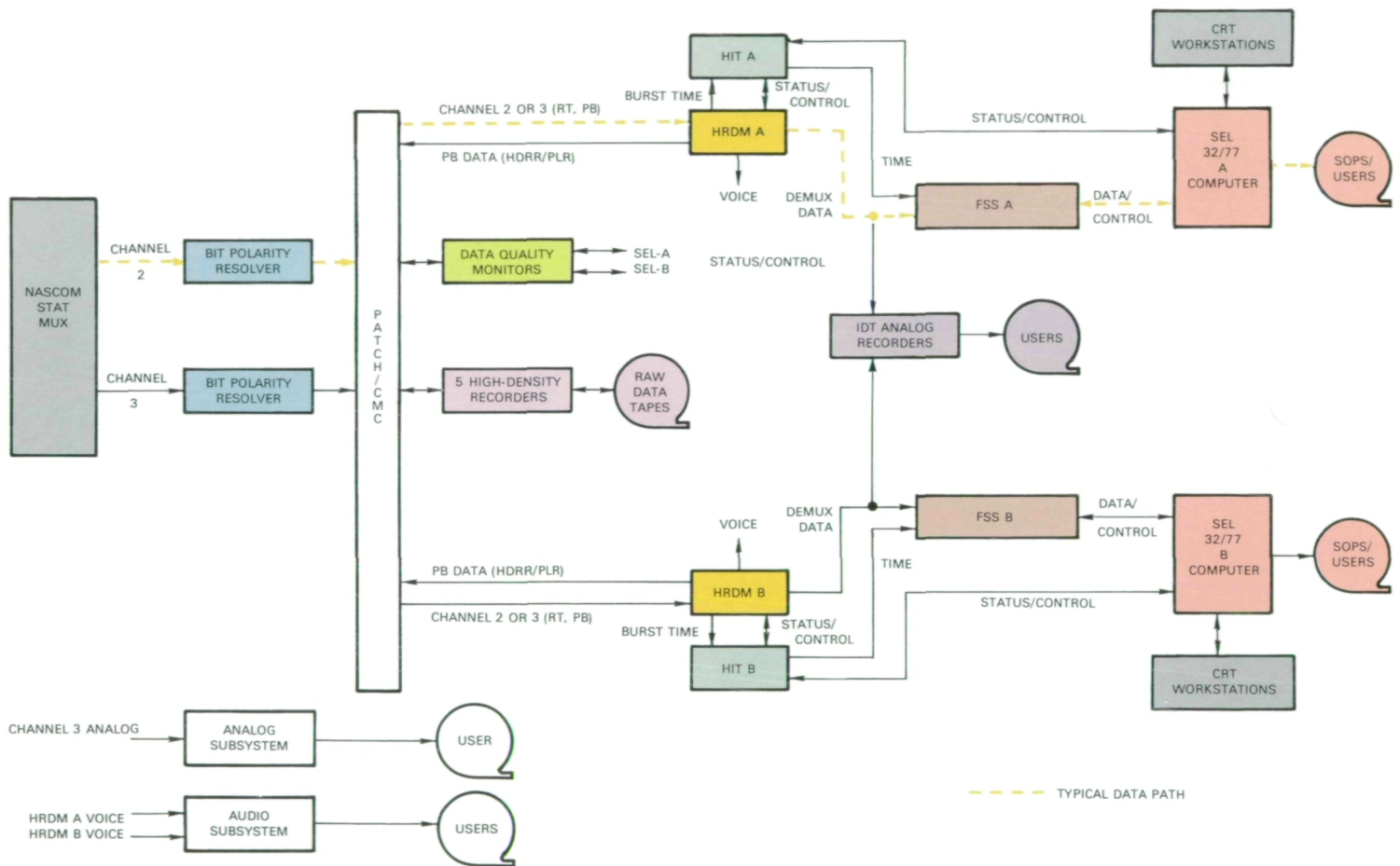
K-Band Signal Processor

The K-band signal processor collects the composite data stream, the analog or video data stream, and the network signal processor output. These various data streams are selected for downlinking over channels 1, 2, or 3.

Analog/Video (A/V) Recorders

There are two onboard A/V recorders onto which data are captured during time intervals without TDRSS coverage.

SIPS Hardware Configuration

CRT WORKSTATIONS

HIT A

BURST TIME

STATUS/CONTROL

CHANNEL 2 OR 3 (RT, PB)

STATUS/CONTROL

HRDM A

PB DATA (HDRR/PLR)

TIME

SEL 32/77 A COMPUTER

SOPS/USERS

VOICE

DEMUX DATA

FSS A

DATA/CONTROL

NASCOM STAT MUX

CHANNEL 2

BIT POLARITY RESOLVER

DATA QUALITY MONITORS

SEL-A
SEL-B

STATUS/CONTROL

P A T C H / C M C

IDT ANALOG RECORDERS

USERS

CHANNEL 3

BIT POLARITY RESOLVER

5 HIGH-DENSITY RECORDERS

RAW DATA TAPES

VOICE

DEMUX DATA

FSS B

DATA/CONTROL

SEL 32/77 B COMPUTER

SOPS/USERS

PB DATA (HDRR/PLR)

TIME

HRDM B

STATUS/CONTROL

CHANNEL 2 OR 3 (RT, PB)

BURST TIME

STATUS/CONTROL

HIT B

CRT WORKSTATIONS

CHANNEL 3 ANALOG

ANALOG SUBSYSTEM

USER

HRDM A VOICE
HRDM B VOICE

AUDIO SUBSYSTEM

USERS

— — — — TYPICAL DATA PATH

The SIPS consists of redundant special-purpose hardware and SEL 32/77 computers which share five high-density recorders. This redundancy ensures real-time processing capabilities. Audio and analog recording subsystems are also included.

High-Rate Demultiplexer (HRDM) – Two Units

Each unit can receive a composite data stream from the NASCOM network or from an HDT. The HRDM performs the inverse function of the HRM and separates the composite stream into the original data signals that were multiplexed onboard the Spacelab. The HRDM is programmable and is indirectly controlled by the SEL.

HRDM Interface Controller and Time Code Converter (HIT) – Two Units

Each unit interfaces the HRDM and the SEL to load the HRDM formats and to monitor the HRDM status. The HIT also converts the HRDM time codes for time tagging the digital data.

Frame Synchronizer Subsystem (FSS) – Two Subsystems

Each FSS consists of 23 Frame Synchronizer Units (FSUs) that accept and synchronize serial data from the HRDM, from the composite stream, or from the HDT read after write. Each FSS passes time tagged data and/or status to the SEL.

Audio Recording and Monitoring Subsystem (ARMS)

This specially designed system accepts the three incoming analog voice channels output from the HRDM. The ARMS will time edit the audio and make user cassette recordings upon request.

Patch/Configuration Manager's Console (CMC)

This console, which interfaces with the SEL, monitors the setup and status of the SIPS hardware and provides signal-patching capabilities.
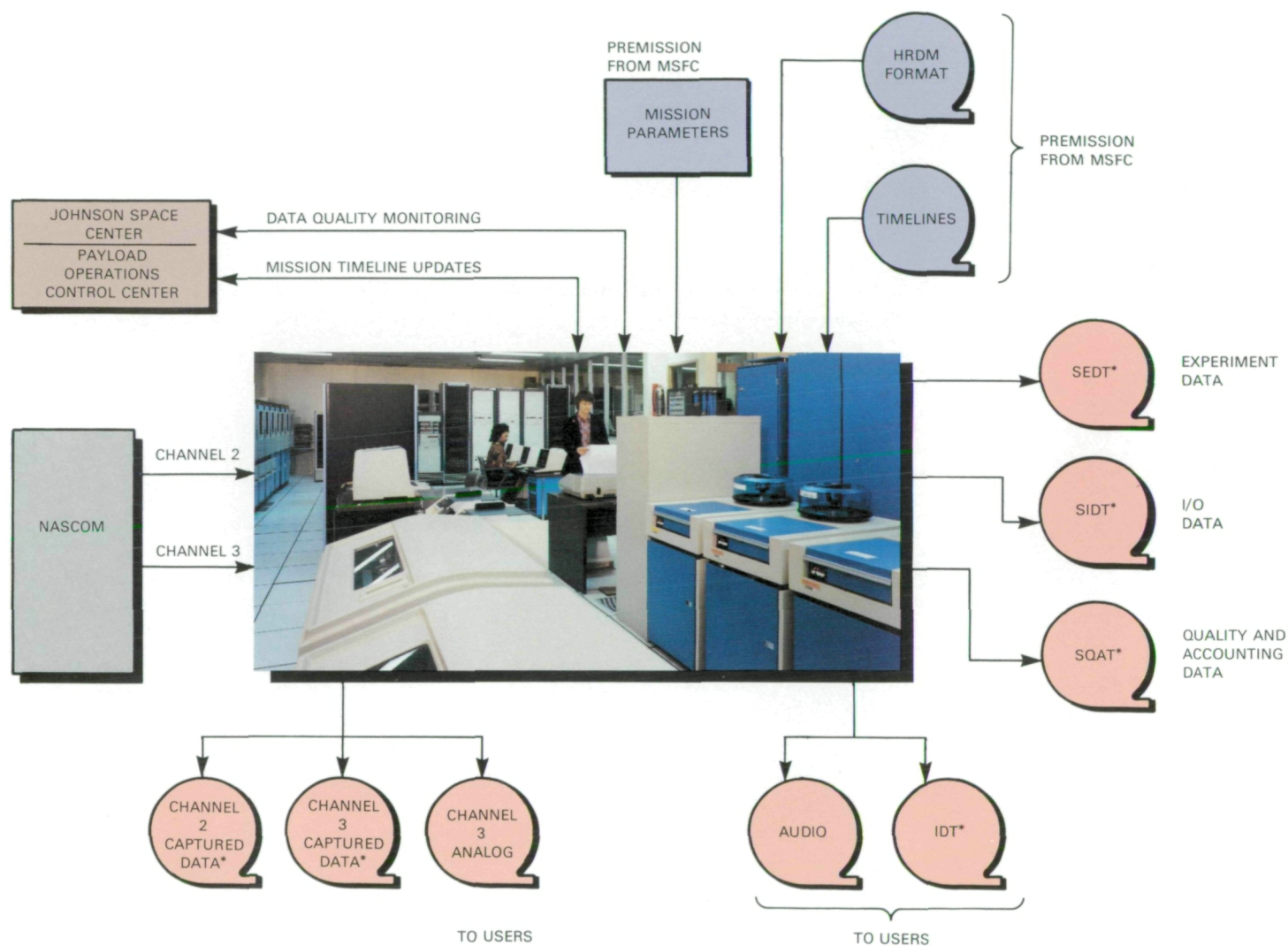
SEL 32/77 Computers – Two Systems

The salient functions performed by each SEL are configuration and timeline control, HRDM format loading, data input, quality assessment, accounting, formatting, and tape generation.

SIPS Functions

— Capture all digital data in real time on HDTs.

— Record the analog data stream in real time.

— Perform data quality monitoring in real time on the composite and demultiplexed data streams.

— Coordinate with the POCC in real time during the mission for data quality monitoring and timeline updates.

— Coordinate with NASCOM.

— Demultiplex the output of the HRM
  — Transfer demultiplexed experiment and I/O channels to the SEL 32/77
  — Record the audio data from the HRDM
  — Record data from selected HRDM channels on IDTs.

— Format and output the demultiplexed dedicated experiment channel data to SEDTs.

— Format and output the demultiplexed experiment computer I/O channel and the subsystem computer I/O channel data to SIDTs.

— Postprocess playback data (HDRR/PLR)
  — Reverse the HDT
  — Demultiplex the playback stream and generate output products.

— Postprocess any channel 2 and/or channel 3 captured data not processed in real time.

— Postprocess direct access channel (DAC) data.

— Perform quality assurance (QA) and accounting procedures prior to shipping.

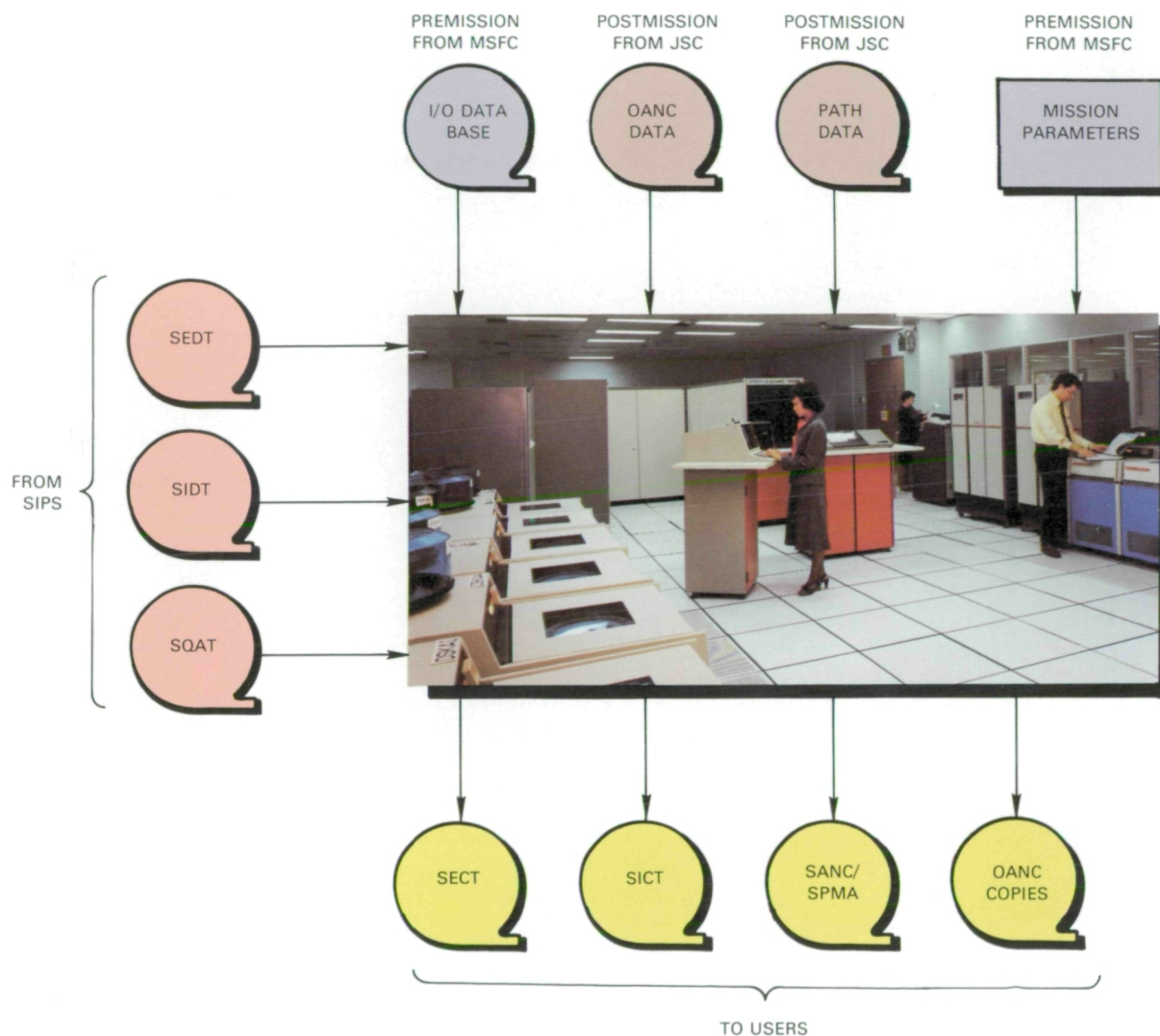— Generate shipping letters for all user tapes.

Spacelab Input Processing System

PREMISSION
FROM MSFC

MISSION
PARAMETERS

HRDM
FORMAT

PREMISSION
FROM MSFC

TIMELINES

JOHNSON SPACE
CENTER

PAYLOAD
OPERATIONS
CONTROL CENTER

DATA QUALITY MONITORING

MISSION TIMELINE UPDATES

NASCOM

CHANNEL 2

CHANNEL 3

SEDT*   EXPERIMENT
               DATA

SIDT*   I/O
               DATA

SQAT*   QUALITY AND
               ACCOUNTING
               DATA

CHANNEL
2
CAPTURED
DATA*

CHANNEL
3
CAPTURED
DATA*

CHANNEL
3
ANALOG

AUDIO

IDT*

TO USERS

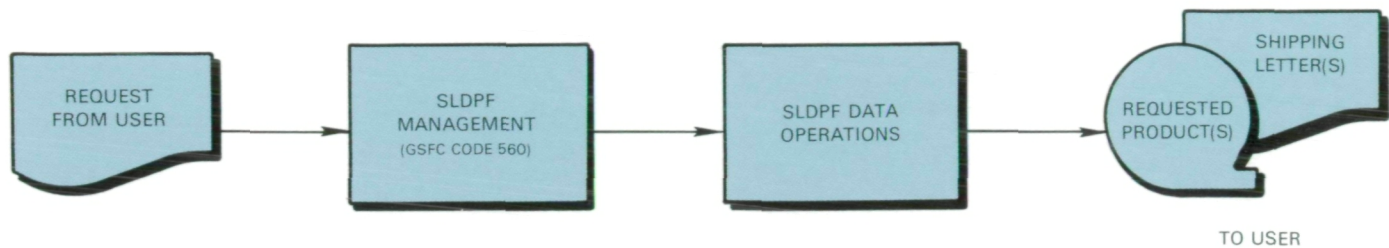TO USERS

*TO USER ON
SPECIAL REQUEST

19

SOPS Functions

— Edit the data.

— Time order the data.

— Remove data overlap.

— Format the experiment data onto individual experiment channel tapes (SECTs).

— Decommutate the I/O data.

— Format the decommutated I/O data onto individual I/O channel tapes (SICTs).

— Produce attitude and ephemeris translations from raw GN&C parameters contained in the EC I/O data.

— Convert selected payload ancillary data downlinked on channel 2 and channel 3 to engineering units.

— Generate ancillary tapes in standard format containing both converted GN&C and other ancillary data (SANCs).

— Perform quality assurance (QA) and accounting procedures before shipping.

— Merge PATH and previously generated SANC data to generate postmission ancillary data (SPMAs).

— Process (copy) OANC data.

— Generate shipping letters for all user tapes.

Spacelab Output Processing System

PREMISSION FROM MSFC — I/O DATA BASE

POSTMISSION FROM JSC — OANC DATA

POSTMISSION FROM JSC — PATH DATA

PREMISSION FROM MSFC — MISSION PARAMETERS

FROM SIPS — SEDT, SIDT, SQAT

SECT SICT SANC/SPMA OANC COPIES

TO USERS

Postmission Reprocessing Requests

REQUEST FROM USER → SLDPF MANAGEMENT (GSFC CODE 560) → SLDPF DATA OPERATIONS → REQUESTED PRODUCT(S) / SHIPPING LETTER(S)

TO USER

User requests for reprocessing are submitted to the GSFC Information Processing Division (Code 560). Copies of the requests are also submitted to the Mission Manager (at the MSFC for early Spacelab missions).

User Recopy Requests . . .

The entire tape is recopied if physical tape problems occur after release from GSFC. Tapes lost in shipment would also fall into this category of reprocessing requests.

User Redo Requests . . .

The original source tapes are used to regenerate data when the user expects the data quality to improve by reprocessing the suspect data.

Spacelab master tapes are archived for 12 months after a mission to ensure that all recopy and redo requests can be fulfilled.

Summary

The SLDPF mirrors the "reusable concept" of the Space Shuttle — input data stream characteristics and output data formats can be varied within the system from mission to mission to ensure a reusable support facility. Parameter files are utilized to adapt the SIPS and SOPS software and hardware to the specific data processing requirements of each user being supported during a given mission.

The SIPS and SOPS are the two major components of the SLDPF. The SIPS captures digital, audio, and analog data. After capturing the digital data, the SIPS demultiplexes, synchronizes, time tags, quality checks, accounts for, and formats the data onto computer-compatible tapes. For further processing the digital data are then transferred to the SOPS where the SLDPF digital processing is completed. The SOPS edits, time orders, blocks, quality checks, formats for distribution, and records the data on tape for shipment to the users. In addition, the SOPS provides the SLDPF ancillary processing and accounts for the SOPS generated data products.

To take advantage of the SLDPF capabilities, the user's experiment must be compatible with the HRM onboard the Spacelab. Data rates must be within 16 Mbps for a dedicated channel and within 50 Mbps for a direct access channel to be acceptable for processing within the SLDPF. For each experiment proposed for a Spacelab mission, the user must provide the SLDPF with certain specific information through the mission manager. The mission manager provides this information to the SLDPF via the data processing requirements document, the HRDM format tape, the premission timeline tapes, and the I/O data base tape.

The SLDPF will provide to the user, as applicable, the following: computer-compatible tapes, audio tapes, analog tapes, high-density tapes, instrumentation data tapes, and related reports/shipping letters.

Additional Reading

1. George C. Marshall Space Flight Center, *Spacelab High Rate Multiplexer Format Standards for Missions 1, 2, and 3*. MSFC-STD-630, Marshall Space Flight Center, Alabama 35812, April 1978.

2. --, *Spacelab Payload Mission 1 Spacelab Data Processing Facility Requirements Document*. JA-015 Revision A, Marshall Space Flight Center, Alabama 35812, October 1982.

3. Computer Sciences Corporation (CSC), *SLDPF Baseline Requirements Document*. CSC/SD-80/6027 UD3, GSFC, Greenbelt, Maryland 20771, October 1982.

4. --, *Interface Control Document for Spacelab Instrumentation Data Tapes (IDTs)*. CSC/SD-80/6119 UD1, GSFC, Greenbelt, Maryland 20771, October 1981.

5. --, *Interface Control Document for Spacelab Input/Output Data Computer Compatible Tapes (SIDTs)*. CSC/SD-79/6122 UD6, GSFC, Greenbelt, Maryland 20771, January 1983.

6. --, *Interface Control Document for Spacelab Experiment Data Computer-Compatible Tapes (SEDTs)*. CSC/SD-79/6121 UD6, GSFC, Greenbelt, Maryland 20771, January 1983.

7. --, *Interface Control Document for Spacelab Mission-1 Analog Data Tapes (ANDTs)*. CSC/SD-82/6027, GSFC, Greenbelt, Maryland 20771, March 1982.

8. --, *Interface Control Document for Spacelab Master Audio Tapes (MATs) and Audio Cassette Tapes (ACTs)*. CSC/SD-81/6006 UD2, GSFC, Greenbelt, Maryland 20771, April 1982.

9. --, *Interface Control Document for Spacelab Input/Output Channel Tapes (SICTs)*. CSC/SD-80/622 UD3, GSFC, Greenbelt, Maryland 20771, August 1983.

10. --, *Interface Control Document for Spacelab Experiment Channel Tapes (SECTs)*. CSC/SD-80/6222 UD3, GSFC, Greenbelt, Maryland 20771, August 1983.

11. --, *Interface Control Document for Spacelab Ancillary Data Tapes (SANCs)*, CSC/SD-80/6216 Revision 1 UD1, GSFC, Greenbelt, Maryland 20771, August 1983.

12. --, *Interface Control Document for Spacelab Quality Control and Accounting Data Computer-Compatible Tapes (SQATs)*. CSC/SD-79/6123 UD6, GSFC Greenbelt, Maryland 20771, January 1983.

13. --, *Interface Control Document for Spacelab Post Mission Ancillary Data Tapes (SPMAs)*. GSFC, Greenbelt, Maryland 20771, to be issued summer of 1983.

Glossary

ARMS	Audio Recording and Monitoring Subsystem		NASA	National Aeronautics and Space Administration
A/V	Analog/Video		NASCOM	NASA Communications
BPI	Bits Per Inch		NCC	Network Control Center
CCT	Computer-Compatible Tape		OANC	Orbiter Ancillary
CCTV	Closed-Circuit Television		PATH	Postflight Attitude and Trajectory History
CMC	Configuration Manager's Console		PCM	Pulse-Code Modulation
DAC	Direct Access Channel		PLR	Payload Recorder
DEMUX	Demultiplexed		POCC	Payload Operations Control Center
Domsat	Domestic Satellite		PB	Playback
EC	Experiment Computer		QA	Quality Assurance
FSS	Frame Synchronizer Subsystem		RT	Real Time
FSU	Frame Synchronizer Unit		SANC	Spacelab Ancillary Data Tape
GN&C	Guidance, Navigation, and Control		SC	Subsystem Computer
GSFC	Goddard Space Flight Center		SECT	Spacelab Experiment Channel Tape
HDRR	High Data Rate Recorder		SEDT	Spacelab Experiment Data Tape
HDT	High-Density Tape		SICT	Spacelab I/O Channel Tape
HIT	HRDM Interface Controller and Time Code Converter		SIDT	Spacelab I/O Data Tape
HRDM	High-Rate Demultiplexer		SIPS	Spacelab Input Processing System
HRM	High-Rate Multiplexer		SEL	Systems Engineering Laboratories
IDT	Instrumentation Data Tape		SL	Spacelab
I/O	Input/Output		SLDPF	Spacelab Data Processing Facility
JSC	Johnson Space Center		SOPS	Spacelab Output Processing System
Kbps	Kilobits per second		SPMA	Spacelab Postmission Ancillary Tape
KSC	Kennedy Space Center		SQAT	Spacelab Quality Control and Accounting Tape
Mbps	Megabits per second		TDRS	Tracking and Data Relay Satellite
MHz	Megahertz		TDRSS	Tracking and Data Relay Satellite System
MSFC	Marshall Space Flight Center		VFI	Verification Flight Instrumentation

NASA
National Aeronautics and
Space Administration

Information Processing Division, Code 560
Mission and Data Operations Directorate
Goddard Space Flight Center
Greenbelt, Maryland 20771
(301) 344-6124

25
25th Anniversary
1958-1983